DECLARATION

I, Natsuko TOSA, of KYOWEY INT'L, 2-32-1301, Tamatsukuri-Motomachi, Tennoji-ku, Osaka-shi, Osaka 543-0014 Japan, hereby declare that I am the translator of the attached document and certify that the said document is a true translation of Japanese Patent Application No. 2001-144558 to the best of my knowledge and belief.

I also declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statements is directed.

Dated December 8, 2004

Signature Natsuko TOSA

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【Title of the Invention】 DISK CARTRIDGE AND DISK APPARATUS

【What is claimed is】

【Claim 1】

A disk cartridge comprising:

a casing including an inner space for accommodating a data storage disk, the casing including an inner surface facing the disk;

an anti-static layer provided on the inner surface of the casing for eliminating static electricity generated on the disk; and

an elastic member provided on the inner surface of the casing.

【Claim 2】

The disk cartridge according to claim 1, wherein the casing is formed with an opening communicating with the inner space, the anti-static layer being formed in a portion facing a recording portion of the disk on the inner surface of the casing and avoiding the opening, the elastic member being formed on the inner surface of the casing at a portion facing a non-recording portion of the disk.

【Claim 3】

The disk cartridge according to claim 2, further comprising;

a shutter being slidable on the casing between a close position and an open position for selectively closing the opening of the casing; and

a projecting hub being attached to a center of the disk, wherein the hub comes into contact with the shutter while the elastic member being compressed when the shutter being in the close position and the disk moving in the casing, so that the disk is spaced from the anti-static layer.

【Claim 4】

The disk cartridge according to claims 1-3, further comprising a conductive member provided on an external surface of the casing, the conductive member being connected to the anti-static layer.

【Claim 5】

A disk apparatus for managing data with respect to the data storage disk according to any one of claims 1-4, comprising:

a disk drive into which the disk cartridge is inserted;

a rotatable holder that is magnetically attached to a metal member of the hub of the disk for holding and rotating the disk;

an actuator that causes the holder and the casing to approach and recede from each other; and

a controller that manages the holder and the actuator;

wherein the controller causes the elastic member to be compressed between the disk and the casing and the actuator to move the holder to a discharge position where the disk is held in contact with the anti-static layer of the casing.

【Claim 6】

The disk apparatus according to claim 5, wherein the controller causes the actuator to move the holder to a rotatable position where the disk and the anti-static layer are spaced enough to allow the disk to rotate freely.

【Claim 7】

The disk apparatus according to claim 5 or 6, wherein the controller causes the actuator to move the holder to an eject position where the disk is ejectable from the disk drive.

【Claim 8】

The disk apparatus according to any one of claims 5-7, wherein the controller causes the holder to rotate through an angle so that all recording area of the disk is discharged.

【Claim 9】

The disk apparatus according to any one of claims 5-8, wherein the holder moves to cause the elastic member to contact the disk and the holder stops to rotate when the disk rotated by the holder is rotating at a rate lower than a predetermined threshold.

【Claim 10】

The disk apparatus according to any one of claims 5-9, further comprising a discharge selecting switch for selectively causing the disk to contact with the anti-static layer.

【Detailed Description of the Invention】

【0001】

【Field of the Invention】

The present invention relates to a disk cartridge to accommodate a storage disk such as an optical disk, magnetic disk or magneto-optical disk. The present invention also relates to a disk apparatus for writing data to or reading data

from a storage disk.

【0002】

【Prior Art】

Conventionally, several kinds of storage disks, such as optical disks, magnetic disks or magneto-optical disks, have been used for storing a large amount of data. A storage disk may be accommodated in a plastic cartridge which is inserted into a disk apparatus for reading or writing data. A storage disk may be unduly charged within the disk cartridge. The static electricity will attract dust. As a result, accumulations of the dust may be built up on the storage disk, which is disadvantageous to conducting proper data reading or data writing by a laser beam.

【0003】

To eliminate influence of accumulation of dust due to the static electricity or influence of the static electricity itself, JP-A-7-153171 discloses a discharge brush disposed inside of the disk cartridge. This brush is brought into contact with the storage disk when the disk cartridge is inserted into the disk apparatus. Another example is disclosed in JP-B1-6-48590 (JP-A-4-134776), which teaches that a movable conductive cloth or other material is arranged between the disk cartridge and the disk apparatus for eliminating charged electricity.

【0004】

【Means for Solving the Problems】

The conventional discharge brush mentioned above is held in contact with the storage disk while this disk is being rotated. Likewise, the conductive cloth as the second example is brought into pressing contact with the storage disk when the rotating disk is about to be stopped. As a result, in both cases, the storage disk contacts the discharge brush or the conductive cloth so that the disk surface may be scratched or even damaged to an unacceptable extent.

【0005】

In conducting data-reading or data-writing with conventional storage disks including the above-described disk (compact disk for example), a laser beam passes through a base plate having a thickness of e.g. 0.6mm-1.2mm and is irradiated onto a recording layer formed on the surface of the base plate. With such an arrangement, the diameter of the laser beam at

the surface of the base plate irradiated by the laser beam is about 1mm, whereby dust or damage on the surface of the base plate has no influence on data-reading or data-writing.

【0006】

However, in recent disk apparatus, the laser beam does not pass through the base plate, but is irradiated from the surface of the base plate which is formed with a protective coat having a thickness less or equal to 100μm and a recording layer (this method is called "fast surface method"). In the above method, since the laser beam is irradiated from the surface of the base plate formed with a recording layer, the diameter of the laser beam irradiated onto the recording layer is smaller than the laser beam which passes through the base plate. As a result, accumulations of the dust due to the static electricity on the recording layer may have influence on data reading or data writing by a laser beam. Further, as the above-described method of the conventional art, if the surface of a recording disk is damaged on discharging, the damage may impede proper data-reading or data-writing when a laser beam is irradiated from the surface of the base plate formed with a recording layer.

【0007】

【Disclosure of Invention】

The present invention has been proposed under the circumstances described above. It is, therefore, an object of the present invention to provide a disk cartridge and a disk apparatus designed to eliminate static electricity without damaging the data-storing region of the storage disk.

【0008】

To solve the above problem, the present invention provides the following technical means.

【0009】

According to a first aspect of the present invention, there is provided a disk cartridge which includes: a casing having an inner space for accommodating a data storage disk, the casing including an inner surface facing the disk; an anti-static layer provided on the inner surface of the casing for eliminating static electricity generated on the disk; and an elastic member provided on the inner surface of the casing.

【0010】

With such an arrangement, the storage disk is spaced from

the anti-static layer since the elastic member internally attached to the casing lies between the storage disk and the anti-static layer in a stable condition. As a result, the storage disk is protected from damage in the stable condition. Further, when the storage disk is moved toward the elastic member, the elastic member contacts the storage disk while being properly compressed, so that the storage disk reliably contacts the anti-static layer. As a result, the storage disk can be discharged while being in a non-rotating state.

【0011】

Preferably, the casing is formed with an opening communicating with the inner space. The anti-static layer is formed in a portion facing a recording portion of the disk on the inner surface of the casing and avoids the opening. The elastic member is formed on the inner surface of the casing at a portion facing a non-recording portion of the disk. As described above, if the anti-static layer is formed in a portion on the inner surface of the casing and avoids the opening, wide area of the recording disk can be discharged at a time, and the recording portion of the recording disk needing to be discharged can reliably discharged. Further, the elastic member is formed on a portion facing a non-recording portion of the disk without need of discharging, thereby having no influence on discharging. Still further, even if the elastic member contacts the recording disk during its rotation, the recording portion is prevented from damaged.

【0012】

Preferably, the disk cartridge of the present invention further includes a shutter which is slidable on the casing between a close position and an open position for selectively closing the opening of the casing, and a projecting hub which is attached to the center of the disk. The hub comes into contact with the shutter while the elastic member being compressed when the shutter is in the close position and the disk moves in the casing, so that the disk is spaced from the anti-static layer. With such an arrangement, even if the recording disk moves in the casing, the disk is prevented from damaged.

【0013】

Preferably, the disk cartridge of the present invention further includes a conductive member provided on an external

surface of the casing, where the conductive member is connected to the anti-static layer.

【0014】

According to a second aspect of the present invention, there is provided a disk apparatus for managing data with respect to the data storage disk according to the above first aspect, including: a disk drive into which the disk cartridge is inserted; a rotatable holder that is magnetically attached to a metal member of the hub of the disk for holding and rotating the disk; an actuator that causes the holder and the casing to approach and recede from each other; and a controller that manages the holder and the actuator. The controller causes the elastic member to be compressed between the disk and the casing and the actuator to move the holder to a discharge position where the disk is held in contact with the anti-static layer of the casing.

【0015】

Preferably, the controller causes the actuator to move the holder to a rotatable position where the disk and the anti-static layer are spaced enough to allow the disk to rotate freely. With such an arrangement, the recording disk is pressed against the anti-static layer, whereby the disk can be discharged without damaging its surface.

【0016】

Further, the controller can cause the actuator to move the holder to a position so that the recording disk is spaced from the anti-static layer while being rotatable. In other words, the controller can move the holder so that the recording disk is moved away from the anti-static layer, whereby the holder rotates the recording disk. In such an instance, the recording disk is properly spaced from the anti-static layer, and the elastic member exists therebetween, whereby the recording disk does not contact the anti-static layer. As a result, proper data-reading or data-writing can be conducted, while the recording disk is prevented from damaged.

【0017】

Preferably, the controller causes the actuator to move the holder to an eject position where the disk is ejectable from the disk drive. With such an arrangement, the casing can be smoothly inserted into and ejected out from the disk drive.

The controller may move the casing in place of moving the holder so that the recording disk contacts the anti-static layer.

【0018】

Preferably, the controller causes the holder to rotate through an angle so that all recording area of the disk is discharged. With such an arrangement, even if the anti-static layer is formed on small area or whole recording portion of the recording disk is not discharged at a time, since the recording disk can be stopped at a determined rotating angle, whole recording portion of the recording disk can be discharged by performing the discharging for several times.

【0019】

Preferably, the holder moves to cause the elastic member to contact the disk and the holder stops to rotate when the disk rotated by the holder is rotating at a rate lower than a predetermined threshold.

【0020】

Preferably, the disk apparatus of the present invention further includes a discharge selecting switch for selectively causing the disk to contact with the anti-static layer. With such an arrangement, as the user can select to perform/stop the discharging, needless discharging can be skipped, thereby reducing the power consumption.

【0021】

Other features and advantages of the present invention will become apparent from the detailed description given below with reference to the accompanying drawings.

【0022】

【Mode for Carrying out the Invention】

The preferred embodiments of the present invention will be described below with reference to the accompanying drawings.

【0023】

Fig. 1 is an exploded perspective view illustrating a disk cartridge 1 according to the present invention. The disk cartridge 1 includes a casing 2 which has an inner empty space to accommodate a storage disk D and a shutter 3 which is supported by the casing 2 in a slidable manner.

【0024】

The storage disk D may be an optical disk, magnetic disk or magneto-optical disk for example. Referring to Fig. 2, the

storage disk D includes a circular base plate 4, a recording region disposed on the base plate 4, and a protection coating (not shown) to cover the recording region. The base plate 4 is made of resin such as polycarbonate or polymethyl methacrylateand has a thickness of about 0.6mm~1.2mm. The base plate 4 includes a circular central portion 4a from which a short cylindrical hub 6 projects. The hub 6 has a surface to which a magnetic member 7 is attached. The base plate 4 of the storage disk D includes an intermediate torus portion 4b (shaded area A in Fig. 2(a)) additionally to the circular central portion 4a, and the remaining area is a recording region.

【0025】

The casing 2 consists of an upper case member 10 and a lower case member 11 both of which are made of plastic. The upper case member 10 and the lower case member 11 are sized to accommodate the storage disk D. The upper case member 10 is formed with an opening 12, while the lower case member 11 with an opening 13. The opening 12 of the upper case member 10 has a rectangular configuration. On the other hand, the opening 13 has a longer width than the opening of the upper case member 10 and elongated in the radial direction of the storage disk D to reach the center of the lower case member 11. The opening 13 allows the passage of the laser beam by an optical head (not shown) to irradiate the recording region of the storage disk D, while also allowing the insertion of a spindle motor 32 (to be described later) to rotate the storage disk D.

【0026】

Referring now to Fig. 3, the lower case member 11 is provided, on its inner side 11a, with a circular, disk-facing portion 15 that is generally equal in size to the storage disk D. The disk-facing portion 15 is provided with an anti-static layer 16 for eliminating the static charge generated on the storage disk D. The anti-static layer 16 is formed to cover the most of the disk-facing portion 15, avoiding the opening 13. The anti-static layer 16 may be made by solidifying conductive paint applied With the above layout, the storage disk D within the casing 2 has its recording region A (see Fig. 2) held in facing relation to the anti-static layer 16. The anti-static layer 16 formed to cover the disk-facing portion 15 of the inner surface

11a of the lower case member 11, avoiding the opening 13 makes it possible to conduct efficient elimination of the static electricity generated on a wide area of the recording region of the storage disk D.

【0027】

The anti-static layer 16 is connected to a metal sheet 17 provided on the outer surface of the lower case member 11. For establishing this electrical connection, the lower case member 11 is formed with a through-hole 18 widthwisely penetrating therethrough. The through-hole 18 includes an inner surface coated with a conductive layer (not shown) contacting with the anti-static layer 16 and the metal sheet 17. When the storage disk D is inserted into a disk apparatus 26, the metal sheet 17 comes into contact with a ground terminal 30 (to be described later) provided on the disk apparatus 26.

【0028】

Referring to Figs. 1, 3 and 4, a generally U-shaped cushion 19 is attached to the central area of the inner surface 11a of the lower case member 11 along the opening 13. The cushion 19 is made of an elastic material with proper hardness including rubber, sponge, etc. The cushion 19 has a determined height which is greater in height than the hub 6 of the storage disk D. The cushion 19 is disposed on the inner surface 11a of the lower case member 11 at the portion the anti-static layer 16 is not formed, thereby prevented from facing the recording region A of the storage disk D. As described above, the cushion 19 is formed at the portion which does not need elimination of the static electricity, while prevented from facing the recording region A of the storage disk D. Thus, there will be no influence on reproducing and recording of data, or eliminating the static electricity.

【0029】

It should be noted that the cushion 19 may be attached not only to the central area of the lower case member 11, but at a peripheral region 15a of the disk-facing portion 15 (avoiding the area formed with the anti-static layer 16). However, considering that the storage disk D is supported by the hub 6 at its center, the cushion 19 is preferably attached to the central area of the lower case member 11.

【0030】

As shown in Fig. 5, a cushion 19' as a modified example of the cushion 19 includes a resilient U-shaped base 20 and a soft top 21 crowning the base. The top 21, is made of rubber for example, so as not to damage the storage disk D upon contacting. On the other hand, as shown in Fig. 6, a cushion 19" as another example of the cushion 19 may include a U-shaped member 22 and a plurality of springs 23 supporting the U-shaped member.

【0031】

Referring back to Fig. 1, the shutter 3 is slidable on the casing 2 for selectively closing and exposing the openings 12, 13 of the upper and lower case members 10, 11. The shutter 3 is formed as a channel in section and provided with an actuation arm 24. In the normal state, a non-illustrated spring urges the shutter 3 in a direction to close the openings 12, 13 of the upper and lower case members 10, 11. When the disk cartridge 1 is inserted into the disk apparatus 26, a non-illustrated shutter actuation mechanism slidably moves the shutter 3 relative to the casing 2 via the arm 24 which works with the insertion of the disk cartridge 1, thereby exposing the openings 12, 13. As a result, a part of the recording region A (see Fig. 2) of the storage disk D and the hub 6 are exposed.

【0032】

Fig. 7 shows the disk cartridge 1 when it is held in a stable condition. The disk cartridge 1 shown in Fig. 7 is seen from its rear side on being inserted into the disk apparatus 26. In Fig. 7, the storage disk D is spaced from the anti-static layer 16 since the cushion 19 internally attached to the casing 2 is greater in height than the hub 6 of the storage disk D to lie between the storage disk D and the anti-static layer 16. As a result, the recording region on the storage disk D is protected from damage in the stable condition.

【0033】

Fig. 8 shows the storage disk D moved in the casing in a jolt. Referring to Fig. 8, the storage disk D does not bump into the anti-static layer 16, since the hub 6 of the storage disk D abuts on the shutter 3 when the storage disk D is moved. The resilient cushion 19 provided near the hub 6 prevents the storage disk D from tilting while being compressed under the pressure of the storage disk. In this manner, the recording region on the storage disk D is more reliably protected from

possible damage.

【0034】

Reference is now made to Fig. 9 illustrating the components of the disk apparatus 26 into which the disk cartridge 1 is inserted. It should be noted that in the disk apparatus according to the present embodiment, the storage disk D does not move closer to a spindle motor 32 (to be described later), but the spindle motor 32 moves closer to the storage disk D.

【0035】

The disk apparatus 26 serves for inserting the disk cartridge 1 to read out data stored in the storage disk accommodated in the casing 2 or write data in the storage disk D. As shown in Fig. 9, the disk apparatus 26 includes a main body 27. The main body 27 is provided with a disk drive 28 into which the disk cartridge 1 is inserted. The disk drive 28 includes a lower wall surface 28a which is provided with a ground terminal 30. The ground terminal 30 is connected to a ground potential in e.g. personal computer provided with the disk apparatus 26. The ground terminal 30 comes into contact with the metal sheet 17 of the lower case member 11 when the disk cartridge 1 is inserted into the disk drive 28.

【0036】

The lower wall surface 28a of the disk drive 28 is formed with an opening 31 in the vicinity of the ground terminal 30. The opening 31 is provided with a spindle motor 32 therein. The spindle motor 32 serves to hold and rotate the storage disk D. To hold the storage disk D, the spindle motor 32 is provided, at its top, with a magnet (not shown) for pulling the hub 6 . Further, The spindle motor 32 is provided with known actuator or cam mechanism and connected to a non-illustrated vertical actuator for vertically moving the spindle motor 32

【0037】

The disk drive 28 is provided, at its deepest portion, with known holding/releasing mechanism 33 for mechanically holding and ejecting the cartridge 1 in/from the disk drive 28. To initiate the releasing of the inserted cartridge 1, an eject switch 36 is provided on a front panel 35 in the vicinity of an insertion slot 34 of the disk drive 28, together with a discharge selecting switch 37 which will be described later.

【0038】

The disk apparatus 26 includes a control unit 40 for electrical control. The control unit 40 includes a microcomputerand a ROM (both not shown). The ROM may store programs necessary to operate the control unit. The controlling unit 40 is connected to the spindle motor 32, the vertical actuator, the hold/release mechanism 33, the eject switch 36, and the discharge selecting switch 37. The controlling unit 40 performs determined control while outputting control signals to the above-described members based on input signals from the control program and switches.

【0039】

Reference is now made to flow charts of Figs. 10-12 and Figs. 13-18, to illustrate a process of eliminating static electricity from the disk cartridge 1. The disk cartridge 1 is inserted in the disk apparatus 26 in a step of eliminating static electricity, which is described referring to the flow chart of Fig. 10.

【0040】

First, at Step 1 (S1), the control unit 40 determines weather or not the disk cartridge 1 has been inserted into the disk apparatus 26. Fig. 13 shows a state in which the disk cartridge 1 has not been inserted into the disk apparatus 26 yet, while Fig. 14 shows a state in which the disk 1 cartridge has been loaded into the disk drive 28 of the disk apparatus 26. When the disk cartridge 1 is inserted into the disk apparatus 26 by a user,a non-illustrated detection sensor provided on hold/release mechanism detects the loading of the disk cartridge 1 into the disk drive 28, thereby outputting a detection signal to the control unit 40.

【0041】

In such an instance, the non-illustrated shutter actuation mechanism moves the actuation arm 24 (see Fig. 1) relative to the disk cartridge 1 to open the shutter 3 (see Fig. 1) of the disk cartridge 1, thereby exposing parts of the recording region on the storage disk D and the hub 6 through the opening 12 or opening 13 (see Fig. 1). At the same time, the metal sheet 17 of the cartridge 1 comes into contact with the ground terminal 30 of the disk apparatus 26. As a result, the anti-static layer 16 on the cartridge 1 is grounded via the metal sheet 17.

【0042】

Based on the detection signal supplied from the detection sensor, the control unit 40 recognizes that the disk cartridge 1 has been inserted into the disk drive 28 (S1: YES). Then, the control unit determines whether or not the discharge selecting switch 37 has been turned on by a user within a predetermined period of time (S2). In the present embodiment, when no or only little static electricity is generated on the storage disk D, for the disk cartridge 1 has been preserved in a quiet place, the switch may be turned on so that the storage disk D is not discharged on insertion of the disk cartridge 1.

【0043】

When the switch 37 is not turned on within a right determined period, (S2: NO), the control unit 40 sends an instruction to the vertical actuator to raise the spindle motor 32 (S3). As shown in Fig. 15, the vertical actuator upwardly moves the spindle motor 32 (as indicated by arrow A1) based on the control signal. Since the top of the spindle motor 32 is provided with a magnet, the magnetic member 7 on the hub 6 of the storage disk D is attached to the top of the spindle motor (S4). Thus, the storage disk D is magnetically retained on the motor 32.

【0044】

Then, the control unit 40 sends an instruction to the vertical actuator to lower the motor 32 (S5). Accordingly, the motor 32 is moved downward (as indicated by arrow A2), as shown in Fig. 16, to the discharge position. At this stage, as the spindle motor 32 magnetically pulls the hub 6, the storage disk D maintains its position while moving downward. The cushion 19 is compressed between the storage disk D and the lower case member 12, while the storage disk D contacts with the anti-static layer 16 of the cartridge 1. In this way, the storage disk D is connected to the ground terminal 30 via the layer 16 and the metal sheet 17. As noted above, the ground terminal 30 is connected with the ground potential, whereby the storage disk D is discharged (S6). In the above process, the discharging of the storage disk D is performed while the storage disk D is in a non-rotating state. Thus, there is no need to worry about the damaging of the recording region of the storage disk D.

【0045】

However, because of the opening 13 formed on the lower case member 11, a part of the disk-facing portion 15 of the lower case member 11 is not formed with the anti-static layer 16. Thus, there may be a non-discharged portion left in the recording region of the storage disk D facing the opening 13, after the discharging operation has been done. To solve the above problem in the present embodiment, an additional or supplemental discharging operation (S7) will be performed for discharging whole recording area A of the storage disk D, as shown in Step 7 and Fig. 11.

【0046】

Referring to Fig. 11, in the additional or second discharging operation, first, the control unit 40 raises the spindle motor 32 (S71) to separate the storage disk D from the anti-static layer 16, as shown in Fig. 17. At this stage, the storage disk D is free to rotate. Then, the storage disk D is rotated through a suitable angle (S72) so that the portion facing the opening 13 or the non-discharged portion of the storage disk D comes above the anti-static layer 16. Then, the spindle motor 32 is lowered to the discharging position shown in Fig. 16 for the second discharging operation (S73). Thus, the storage disk D is held in contact with the anti-static layer 16, whereby the portion of the storage disk D facing the opening 13 is discharged (S74). If there is still a non-discharged portion after the second discharging operation, a third (maybe more) discharging operation will be performed untilwhole area on the storage disk D have been properly discharged.

【0047】

Referring back to Fig. 10, the control unit 40 moves the storage disk D so that the storage disk D is brought to the rotatable position shown in Fig. 17. Specifically, the control unit 40 raises the spindle motor 32 (S8) to separate the storage disk D from the anti-static layer 16, so that the storage disk D is brought to the position shown in Fig. 17. As a result, the compressed cushion 19 is detached from the storage disk D, to be restored to the original shape, while the storage disk D becomes rotatable.

【0048】

Then, the control unit 40 sends an instruction to the spindle motor 32 to rotate, whereby the spindle motor 32 rotates in

a determined direction at a determined speed (S9),. Accordingly, the storage disk D is brought into rotation during which a laser beam from the optical head (not shown) irradiates the recording region of the storage disk D for reading or writing data (S10). The storage disk D may continue to rotate after data-reading or data-writing operation, or the rotation of the storage disk D may be stopped for energy saving when it is not read or written.

【0049】

According to the present invention, the storage disk D being rotated is appropriately spaced from the anti-static layer 16 and the cushion 19 lies therebetween. Thus, the recording region of the storage disk D will not be damaged. Further, even if the cushion 19 comes into contact with the storage disk D, the possible contact point of the cushion 19 is not on the recording region, but on the other portions on the storage disk D. Thus, the data-reading or data-writing operation is properly performed with respect to the storage disk D. Another advantage in the above embodiment is that the static electricity generated on the storage disk D can be discharged immediately after the cartridge 1 is inserted into the disk apparatus 26. With such a precaution, it is possible to perform more reliable data-processing operations.

【0050】

Turning back to Step 2, when the discharge selecting switch 37 is turned on (S2: YES) by a user, no discharging operation is performed after the insertion of the disk cartridge 1. In this case, the control unit 40 raises the storage disk D to the rotatable position together with the spindle motor 32 and then rotates the motor 32 (S8, S9) for data-processing (S10).

【0051】

If the loading time of the storage disk D is longer than expected, discharging on insertion of the disk cartridge 1 may be stopped by user's turning on the switch as described above. In this way, loading time of the storage disk D can be reduced. Further, as the user can select to perform/stop the discharging, needless discharging can be skipped, thereby reducing the power consumption.

【0052】

Reference is now made to a flow chart of Fig. 12 to illustrate

the process of ejecting the disk cartridge 1 from the disk apparatus 26. First, the control unit 40 determines whether or not the eject switch 36 has been turned on after the data-reading or -writing operation is over (s21). When the eject switch 36 is turned on (S21: YES), the control unit 40 will terminate the rotation of the spindle motor 32, while monitoring the rotation speed of the storage disk D based on detection signals supplied from a non-illustrated rev counter. Through this, the control unit 40 determines whether or not the rotation speed of the storage disk D is below a predetermined threshold (S22). When the rotation speed is found to be equal to or below the threshold (S22: YES), while the storage disk D is still in rotation, the spindle motor 32 is lowered (S23).. As a result, the storage disk D is brought into contact with the cushion 19, thereby coming to a halt by friction (S24). Thus, in this stage, the cushion 19 serves as a brake for stopping rotation of the storage disk D, thereby preventing the storage disk D from being discharged when it is still rotating.

【0053】

Thereafter, the control unit 40 lowers the spindle motor 32 to the discharging position shown in Fig. 16. The spindle motor 32 moves together with the storage disk D while holding the hub 6. The cushion 19 is compressed between the storage disk K and the lower case member 11 and the storage disk D contacts the anti-static layer 16, so that it can be discharged (S25). In this case, as shown in Fig. 11, an additional discharging operation may be performed (S26).

【0054】

Then, the control unit 40 lowers the spindle motor 32 further to a turnout position (S27), so that the magnetic member 7 is detached from the magnet of the spindle motor 32 to be detached from the hub. As a result, the storage disk D is moved away from the anti-static layer 16 by the cushion 19, whereby the spindle motor 32 moves to the detached position as shown in Fig. 14.

【0055】

Then, the control unit 40 sends an instruction to the holding/releasing mechanism 33 to eject the disk cartridge 1. Upon receiving this instruction, the mechanism 33 stops holding

the casing 2 of the cartridge (S28). As a result, the cartridge 1 is ejected from the disk apparatus 26 (S29), as shown in Fig. 18.

【0056】

In the above-described embodiment, the disk cartridge 1 is discharged before the ejected. Thus, the user may be able to use this disk cartridge again without subjecting it to the initial discharging process. Further, since the terminal discharging is performed in the course of the ejection of the storage disk D, the entire disk cartridge-handling procedure can be shortened in time.

【0057】

In the above-described embodiment, a laser beam irradiated to the storage disk D is arranged to strike on the lower side of the storage disk D. However, as shown in Fig. 19, a laser beam may strike on the upper side of the storage disk D to discharge the recording region on the upper side of the storage disk. In this case, the ground terminal 30 is provided in the upper wall surface 28b of the disk drive 28, and accordingly, the anti-static layer 16 and the cushion 19 may be provided on the upper case member 10 of the disk cartridge 1.

【0058】

Further, the laser beam may strike on both the upper and the lower sides of the storage disk D. In this case, each of the upper and lower wall surfaces 28b, 28a of the disk drive 28 may be provided with the ground terminal 30, while each of the upper and the lower case members 10, 11 may be provided with an anti-static layer 16 and a cushion 19.

【0059】

Of course, the present invention is not limited to the above-described embodiments. For example, the casing 2 may be made of a conductive material to serve as a discharging member, instead of providing the anti-static layer 16, which contacts the storage disk D, at the inner surface 11a of the casing 2. In this case, the casing 2 is caused to contact with the storage disk D by increasing its thickness or by forming a protrusion at the inner surface 11a. With such an arrangement, there is no need to form the anti-static layer 16, thereby reducing the production costs.

【0060】

Further, the anti-static layer 16 may be formed to cover only a small area of the portion facing the storage disk D, instead of being formed on generally whole of the disk-facing portion at the inner surface 11a of the lower case member 11 in the above embodiment.

【0061】

Still further, in the above embodiment, the spindle motor 32 is vertically movable to approach or recede from the casing 2. Instead, the spindle motor 32 may be stationary, while the casing 2 may be replaceable relative to the spindle motor 32. With such an arrangement, the above-described functions and advantages can be obtained.

【0062】

Still further, in the above embodiment, the disk apparatus 26 is a horizontal type in which the casing 2 is inserted horizontally, though it may be a vertical type in which the casing 2 is inserted vertically.

【0063】

(Claim Candidate 1) A disk cartridge comprising:

a casing including an inner space for accommodating a data storage disk, the casing including an inner surface facing the disk;

an anti-static layer provided on the inner surface of the casing for eliminating static electricity generated on the disk; and

an elastic member provided on the inner surface of the casing.

(Claim Candidate 2) The disk cartridge according to Claim Candidate 1, wherein the casing is formed with an opening communicating with the inner space, the anti-static layer being formed in a portion facing a recording portion of the disk on the inner surface of the casing and avoiding the opening, the elastic member being formed on the inner surface of the casing at a portion facing a non-recording portion of the disk.

(Claim Candidate 3) The disk cartridge according to Claim Candidate 2, further comprising;

a shutter being slidable on the casing between a close position and an open position for selectively closing the opening of the casing; and

a projecting hub being attached to a center of the disk,

wherein the hub comes into contact with the shutter while the elastic member being compressed when the shutter being in the close position and the disk moving in the casing, so that the disk is spaced from the anti-static layer.

(Claim Candidate 4) The disk cartridge according to Claim Candidate 3, wherein the hub is provided with a magnetic member.

(Claim Candidate 5) The disk cartridge according to any one of Claim Candidates 1-4, further comprising a conductive member provided on an external surface of the casing, the conductive member being connected to the anti-static layer.

(Claim Candidate 6) A disk apparatus for managing data with respect to the data storage disk according to any one of Claim Candidates 1-5, comprising:

a disk drive into which the disk cartridge is inserted;

a rotatable holder that is magnetically attached to a metal member of the hub of the disk for holding and rotating the disk;

an actuator that causes the holder and the casing to approach and recede from each other; and

a controller that manages the holder and the actuator;

wherein the controller causes the elastic member to be compressed between the disk and the casing and the actuator to move the holder to a discharge position where the disk is held in contact with the anti-static layer of the casing.

(Claim Candidate 7) The disk apparatus according to Claim Candidate 6, wherein the controller causes the actuator to move the holder to a rotatable position where the disk and the anti-static layer are spaced enough to allow the disk to rotate freely.

(Claim Candidate 8) The disk apparatus according to Claim Candidate 6 or 7, wherein the controller causes the actuator to move the holder to an eject position where the disk is ejectable from the disk drive.

(Claim Candidate 9) The disk apparatus according to Claim Candidate 6, wherein the disk drive is provided with a ground terminal held at a ground potential, the ground terminal coming into contact with a conductive member provided on the disk cartridge when the cartridge is inserted into the disk drive.

(Claim Candidate 10) The disk apparatus according to any one of Claim Candidates 6-9, wherein the controller causes the holder to rotate through an angle so that all recording area

of the disk is discharged.

(Claim Candidate 11) The disk apparatus according to any one of claims 5-8, wherein the holder moves to cause the elastic member to contact the disk and the holder stops to rotate when the disk rotated by the holder is rotating at a rate lower than a predetermined threshold.

(Claim Candidate 12) The disk apparatus according to any one of Claim Candidates 6-11, further comprising a discharge selecting switch for selectively causing the disk to contact with the anti-static layer.

(Claim Candidate 13) The disk apparatus according to any one of Claim Candidates 6-12, wherein the controller causes the actuator to move the holder for bringing the disk into contact with the anti-static layer when the disk is inserted into the disk drive.

(Claim Candidate 14) The disk apparatus according to any one of Claim Candidates 6-13, wherein the controller causes the actuator to move the holder for bringing the disk into contact with the anti-static layer when the disk is about to be ejected from the disk drive.

(Claim Candidate 15) The disk apparatus according to any one of Claim Candidates 6-14, wherein the holder is disposed opposite to the anti-static layer with respect to the disk.

【0064】

【Advantages of the Invention】

According to the present invention, the storage disk is spaced from the anti-static layer since the elastic member internally attached to the casing lies between the storage disk and the anti-static layer in a stable condition. Further, when the storage disk is moved toward the elastic member, the elastic member contacts the storage disk while being properly compressed, so that the storage disk reliably contacts the anti-static layer. As a result, the storage disk can be discharged while being in a non-rotating state.

【BRIEF DESCRIPTION OF THE DRAWINGS】

【Fig. 1】 is an exploded perspective view showing a disk cartridge embodying the present invention.

【Fig. 2】 consists of a bottom view (a) and a side view (b) showing the storage disk of Fig. 1.

【Fig. 3】 consists of a top view (a), a sectional vies

taken along lines B-B in (a), and a sectional view taken along lines C-C in (a), showing the lower case member of the disk cartridge.

【Fig. 4】 is a perspective view showing a cushion.

【Fig. 5】 is a perspective view showing an example of modified cushion.

【Fig. 6】 is another example of modified cushion.

【Fig. 7】 shows the disk cartridge held in the natural state.

【Fig. 8】 shows the disk cartridge held in a vibrant state.

【Fig. 9】 shows the basic components of a disk apparatus embodying the present invention.

【Fig. 10】 is a flow chart illustrating the operation of a controller.

【Fig. 11】 is a flow chart illustrating the operation of a controller.

【Fig. 12】 is a flow chart illustrating the operation of a controller.

【Fig. 13】 illustrates how the disk cartridge is inserted into the disk apparatus.

【Fig. 14】 illustrates the cartridge-loaded conditions in the disk drive.

【Fig. 15】 illustrates the cartridge-loaded conditions in the disk drive.

【Fig. 16】 illustrates the cartridge-loaded conditions in the disk drive.

【Fig. 17】 illustrates the cartridge-loaded conditions in the disk drive.

【Fig. 18】 illustrates how the disk cartridge is ejected from the disk drive.

【Fig. 19】 illustrates an example of modified disk apparatus.

【Legends】

1 disk cartridge
2 casing
6 hub
7 magnetic member
16 anti-static layer
19 cushion
26 disk apparatus

32 spindle motor
40 control unit
D storage disk

【Identification of the Document】 ABSTRACT

【Abstract】

【Object】

To provide a disk cartridge for eliminating the static electricity without damaging a recording region of a storage disk.

【Means for Solution】

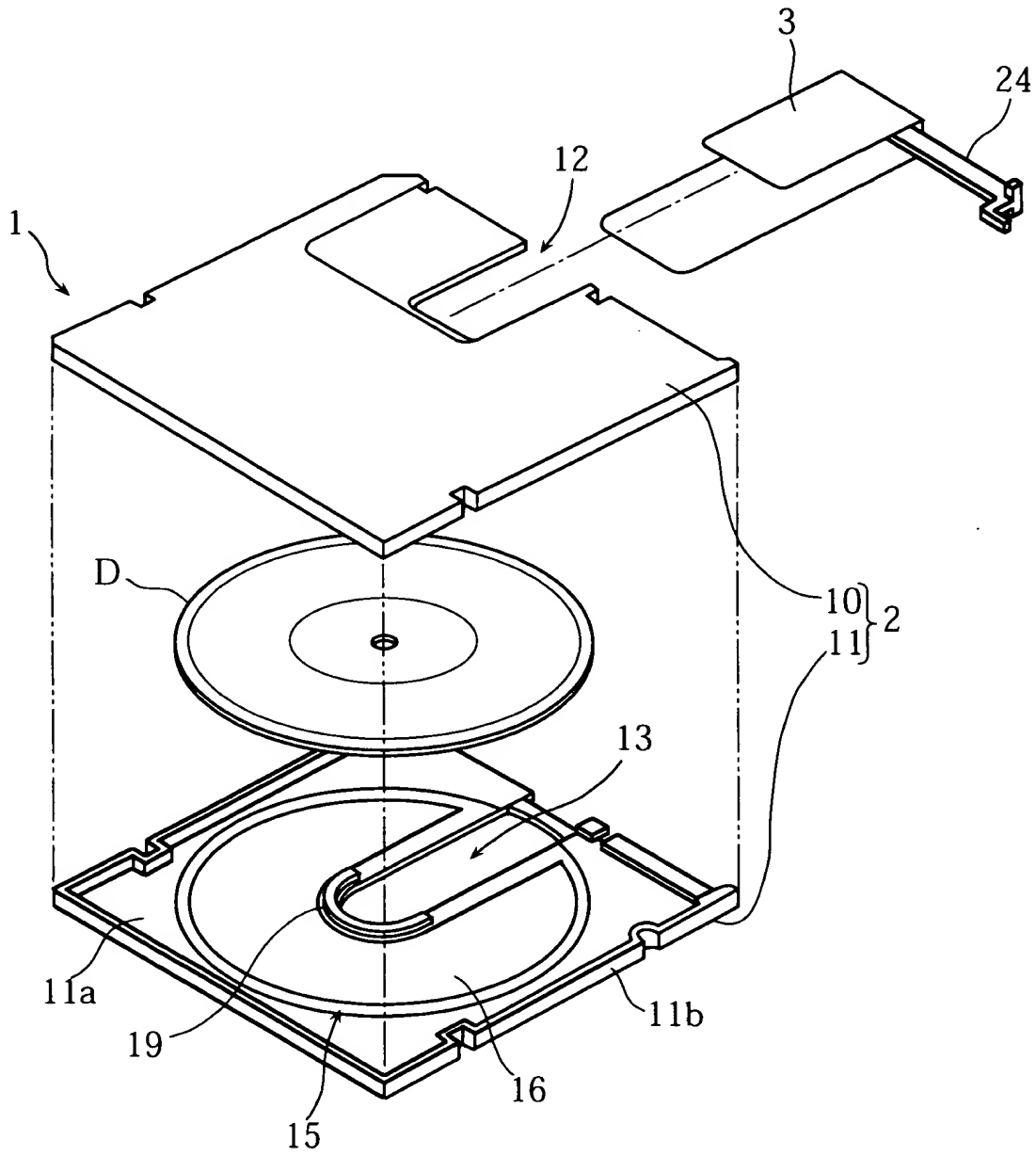
A disk cartridge 1 includes a casing 2 having an inner space for accommodating a storage disk D. The casing 2 has an inner surface facing the storage disk D. An anti-static layer 16 is provided on the inner surface of the casing for eliminating the static electricity generated on the storage disk D. An elastic member or cushion 19 is also provided on the inner surface of the casing.

【Selected Figure】 Fig. 1

【Identification of Document】 Drawings

【Fig. 1】

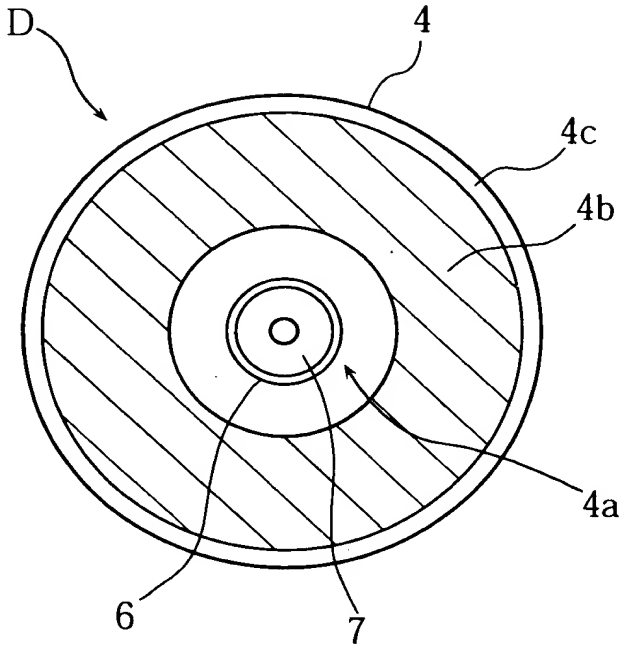
AN EXPLODED PERSPECTIVE VIEW SHOWING A DISK CARTRIDGE EMBODYING THE PRESENT INVENTION



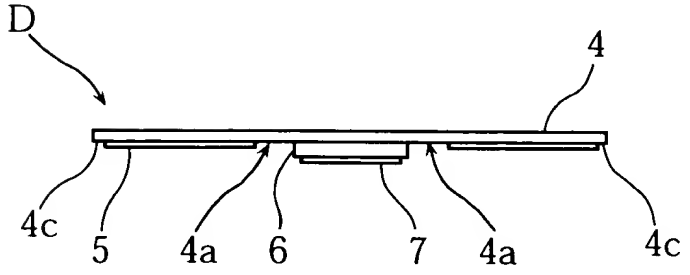
【Fig. 2】

A BOTTOM VIEW (a) AND A SIDE VIEW (b) SHOWING THE STORAGE DISK OF FIG.1

(a)

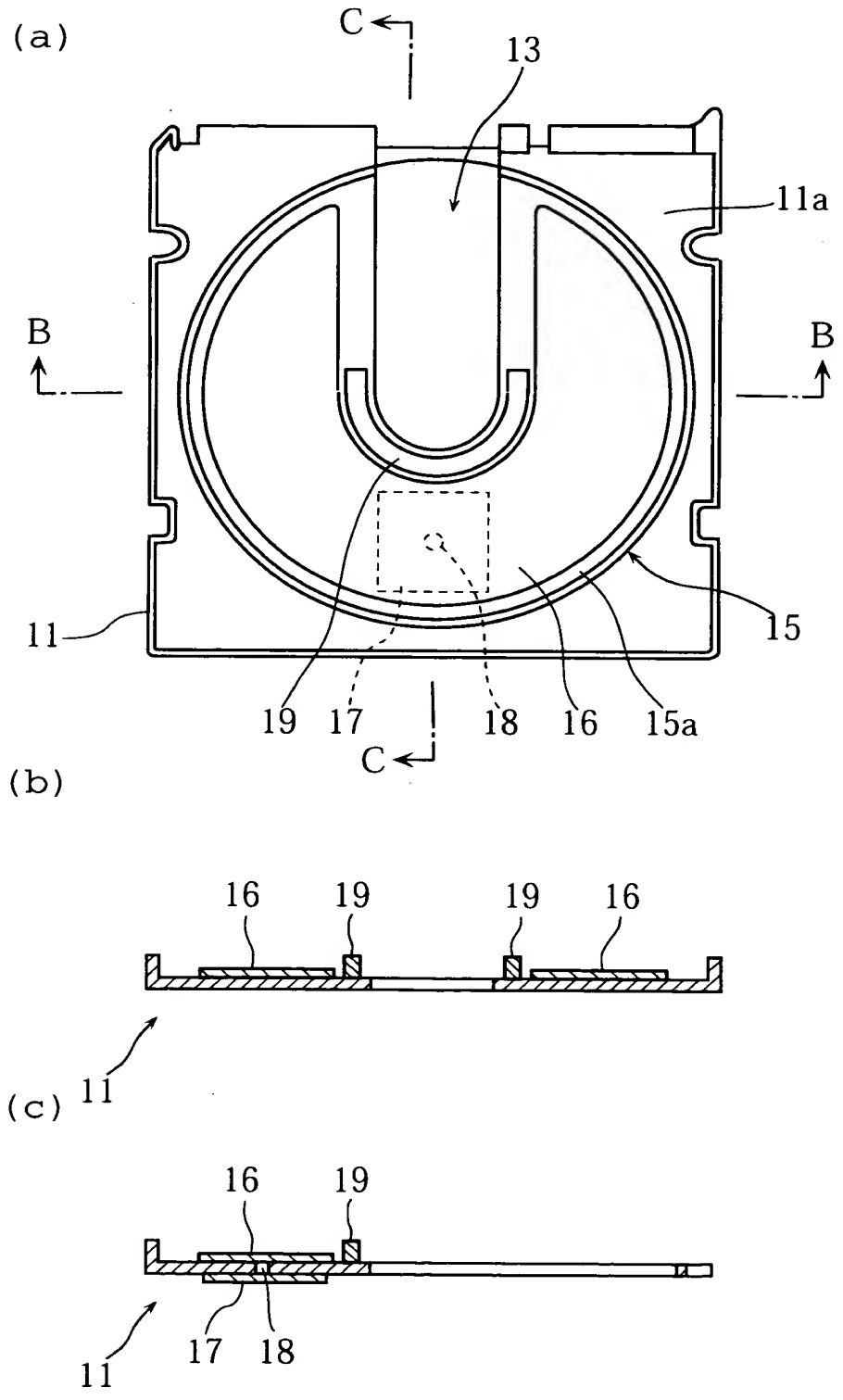


(b)



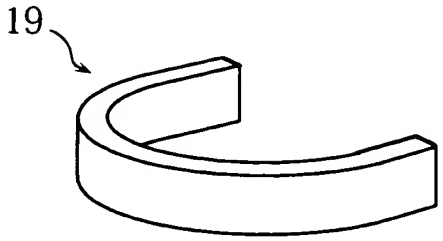
【Fig. 3】

A TOP VIEW (a), A SECTIONAL VIES TAKEN ALONG LINES B-B IN (a), AND A SECTIONAL VIEW TAKEN ALONG LINES C-C IN (a), SHOWING THE LOWER CASE MEMBER OF THE DISK CARTRIDGE



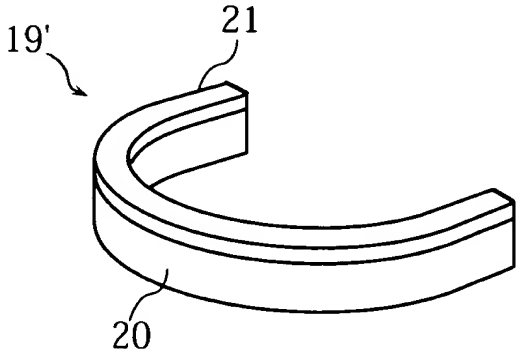
【Fig. 4】

A PERSPECTIVE VIEW SHOWING A CUSHION



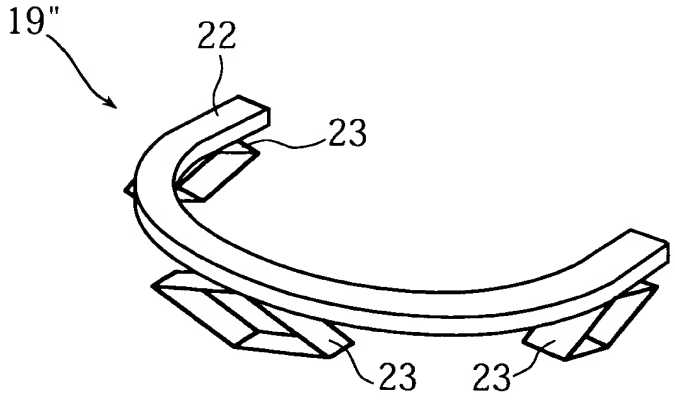
【Fig. 5】

A PERSPECTIVE VIEW SHOWING AN EXAMPLE OF MODIFIED CUSHION



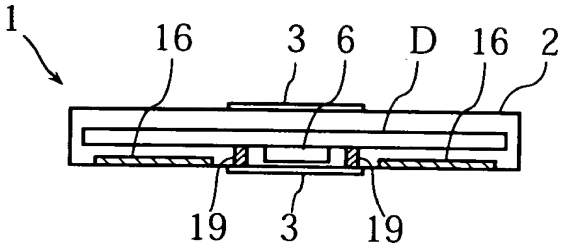
【Fig. 6】

ANOTHER EXAMPLE OF MODIFIED CUSHION



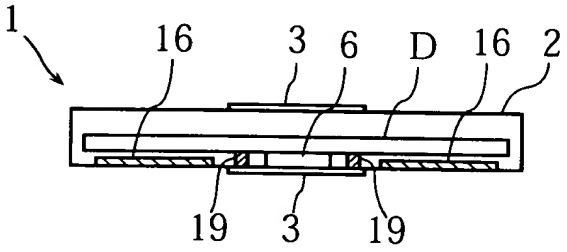
【Fig. 7】

THE DISK CARTRIDGE HELD IN THE NATURAL STATE



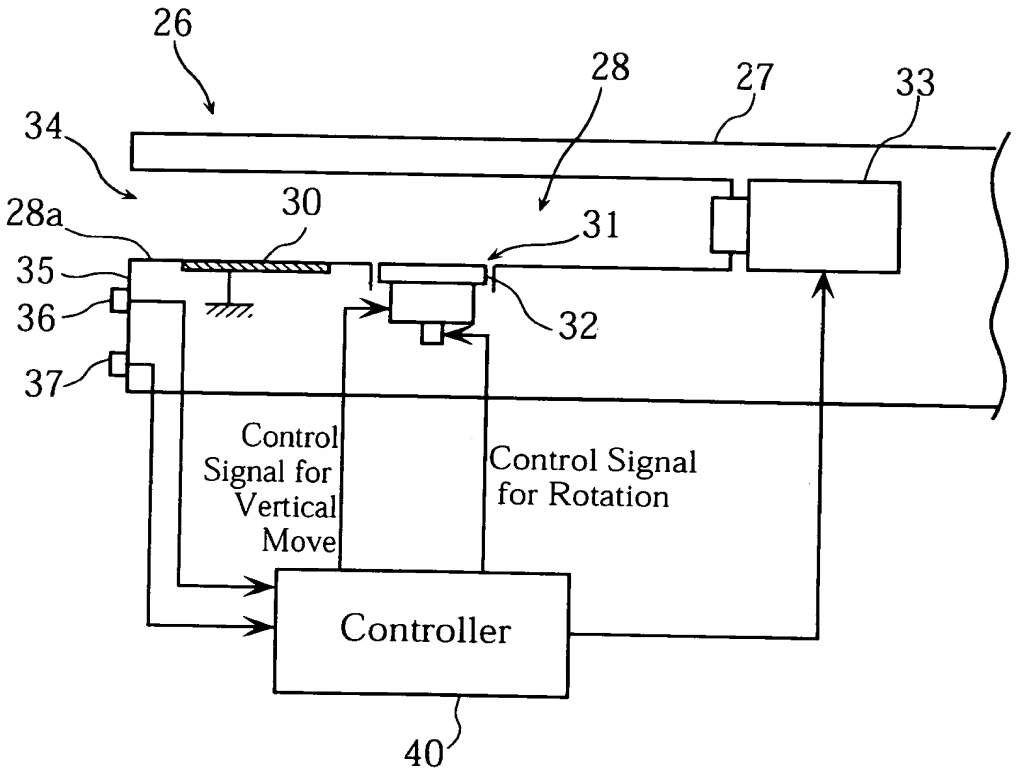
【Fig. 8】

THE DISK CARTRIDGE HELD IN A VIBRANT STATE



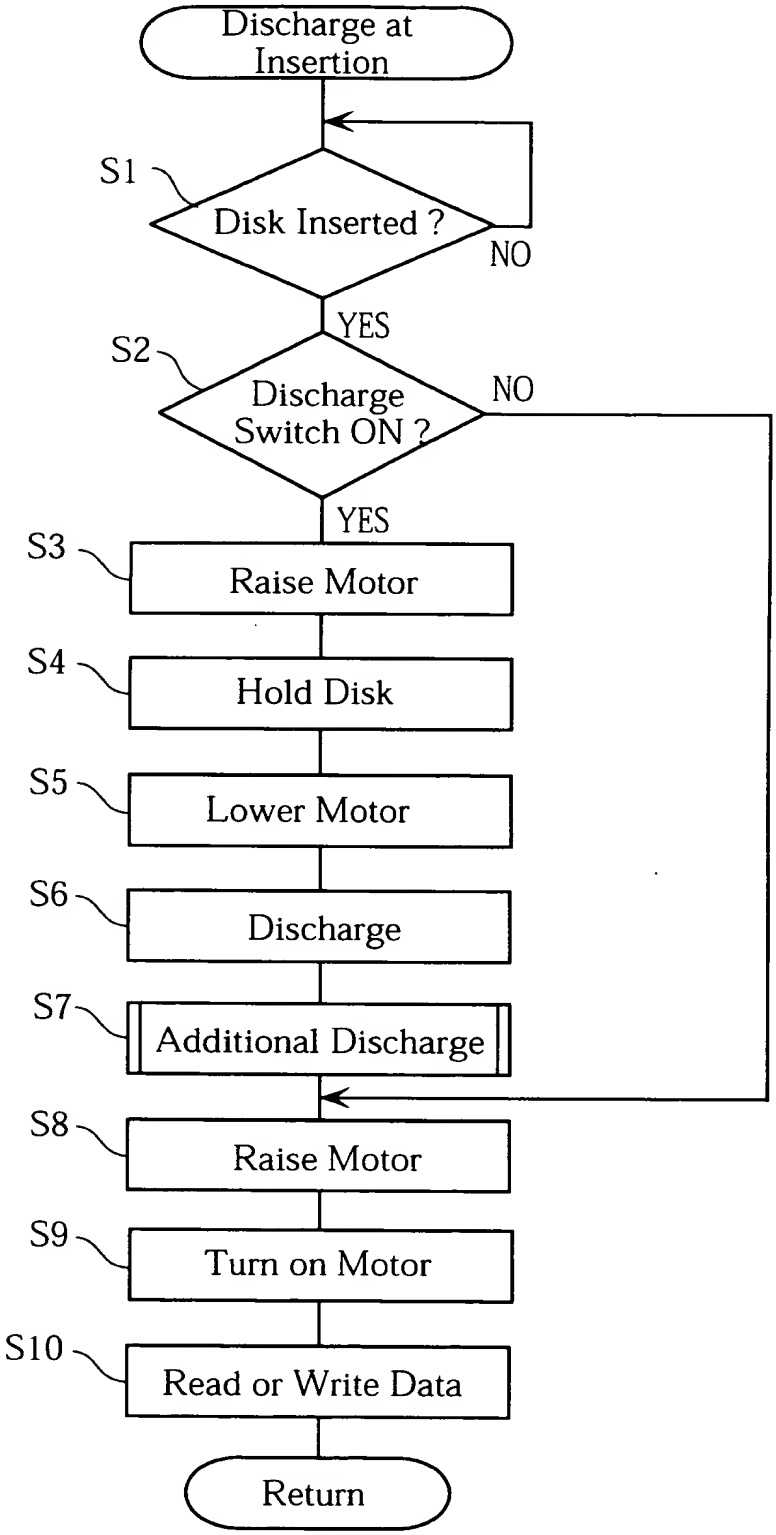
【Fig. 9】

THE BASIC COMPONENTS OF A DISK APPARATUS EMBODYING THE PRESENT INVENTION



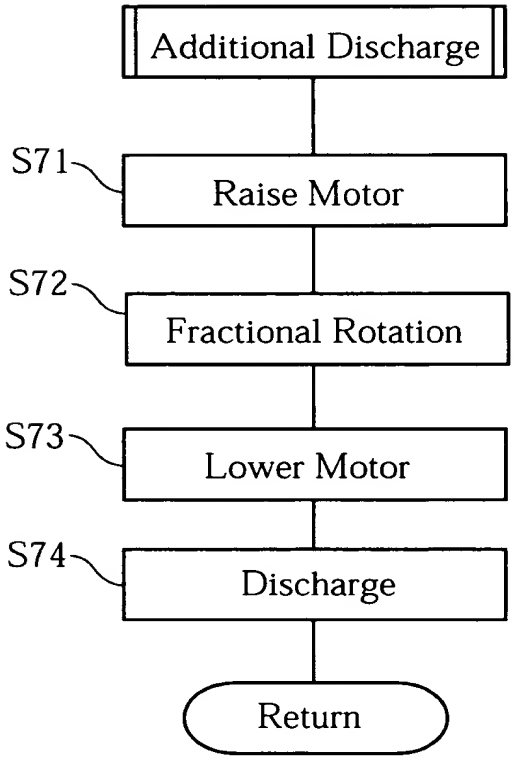
【Fig. 10】

A FLOW CHART ILLUSTRATING THE OPERATION OF A CONTROLLER



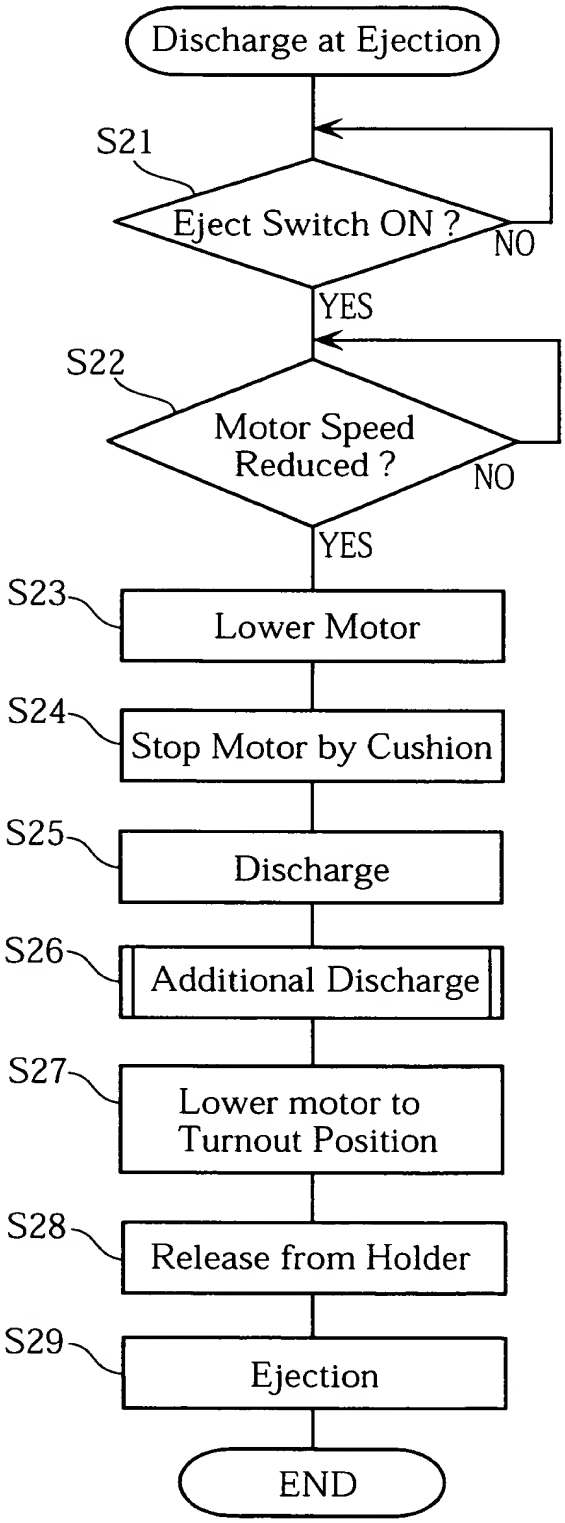
【Fig. 11】

A FLOW CHART ILLUSTRATING THE OPERATION OF A CONTROLLER



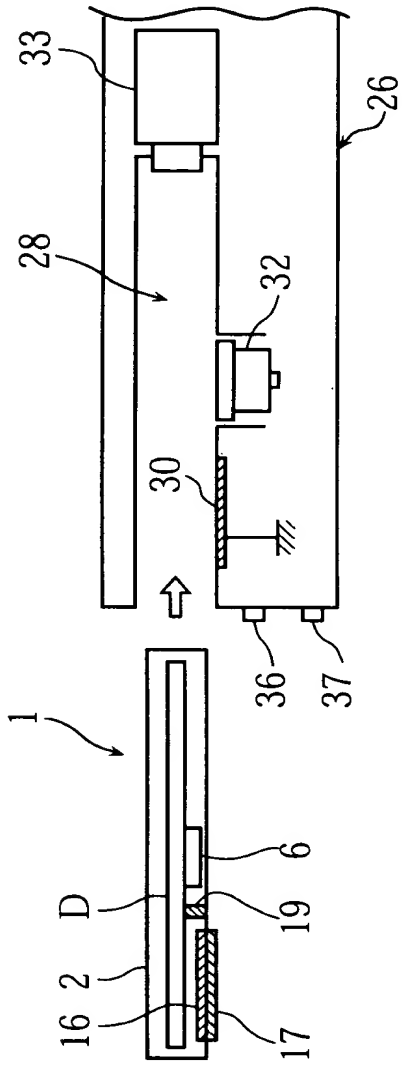
【Fig. 12】

A FLOW CHART ILLUSTRATING THE OPERATION OF A CONTROLLER



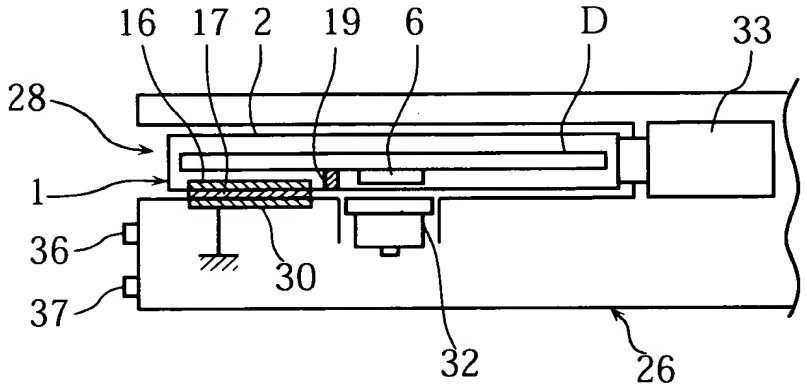
【Fig. 13】

HOW THE DISK CARTRIDGE IS INSERTED INTO THE DISK APPARATUS



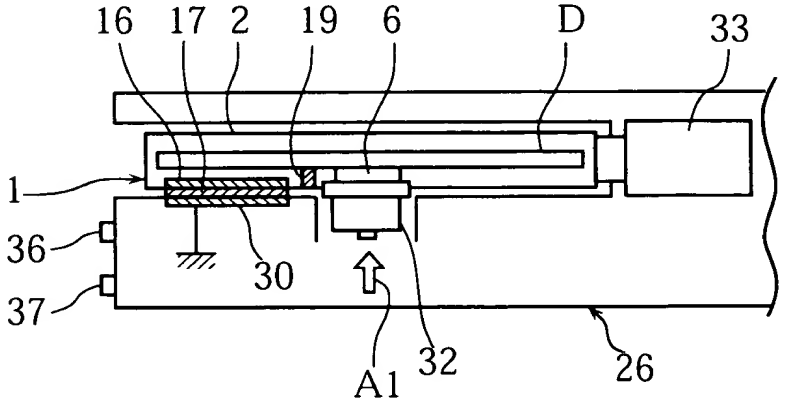
【Fig. 14】

THE CARTRIDGE-LOADED CONDITIONS IN THE DISK DRIVE



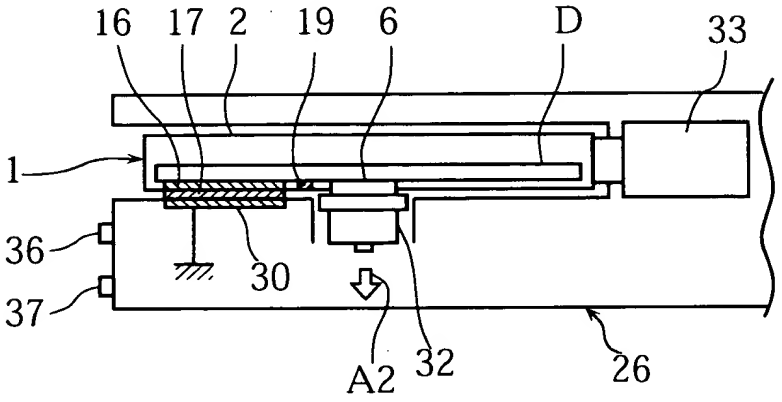
【Fig. 15】

THE CARTRIDGE-LOADED CONDITIONS IN THE DISK DRIVE



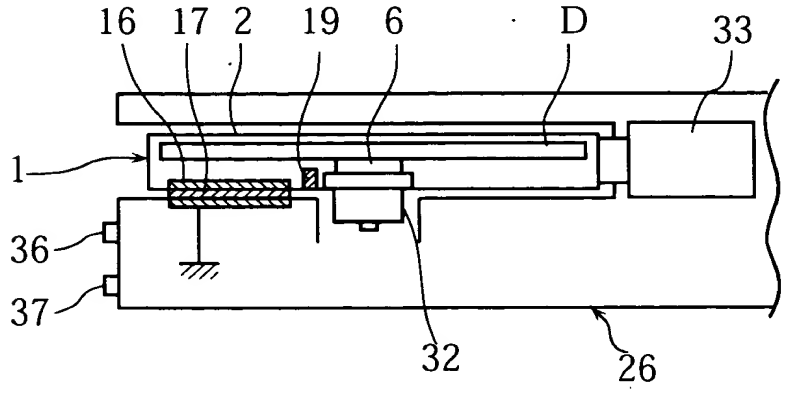
【Fig. 16】

THE CARTRIDGE-LOADED CONDITIONS IN THE DISK DRIVE



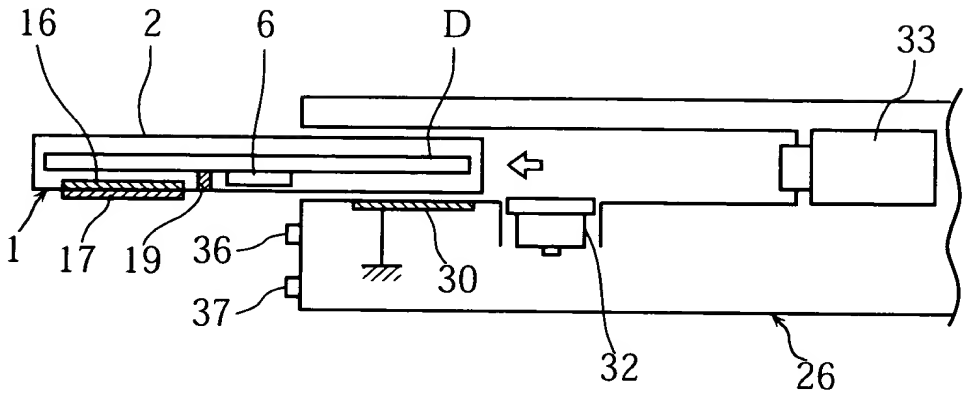
【Fig. 17】

THE CARTRIDGE-LOADED CONDITIONS IN THE DISK DRIVE



【Fig. 18】

HOW THE DISK CARTRIDGE IS EJECTED FROM THE DISK DRIVE



【Fig. 19】

AN EXAMPLE OF MODIFIED DISK APPARATUS